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## **EFFECTIVENESS OF ELEMENTS PERIODIC TABLE INTERACTIVE MULTIMEDIA IN NGUYEN TAT THANH HIGH SCHOOL**

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### **Abstract**

The result of observation and interview shows that the learning process in Nguyen Tat Thanh High School was going fun and everyday teacher used different method of learning, sometimes teacher also made a worksheet for students, but the power point presentation media that teacher used did not show the interaction between media, teacher and students. Also there were unnecessary pictures on the power point that could distract students focus and the colour combination was not suitable. This research aimed to develop an interactive multimedia and know its feasibility and effectiveness. This study had significance to develop an alternative instructional multimedia in an education game way so could increase students' motivation and learning outcome. The design of this research was Research and Development with ADDIE model. The data of this research were obtained from validation result from media expert and instructional expert, students' response at small scale test, post test result and students' response at large scale test. The score of validation result for the media expert was 96 categorized as very feasible and for the instructional expert was 62 categorized as feasible. Small scale test result showed that students gave very good response with 69.97 score. Students' post test gave effective result with classical completeness 61.76% and very good response with 68.5 score. It can be concluded that the elements periodic table interactive multimedia was feasible and effective to be used in learning process, and have very good response from the students as users.

**Keywords:** interactive multimedia, elements periodic table, effectiveness

### **Introduction**

Nguyen Tat Thanh High School is a Lower and Upper Secondary Education located in Ciau Giay, Hanoi, Viet Nam. This school is under Hanoi National University of Education. Nguyen Tat Thanh High School has 51 classrooms with 2.132 students. It has a proper condition to study. Each class has LCD, projector, lockers, AC, fan, and seats for students; has two computer laboratories; a language laboratory; canteen; counselling office; teacher room in each floor; a meeting room; principal room; vice principal room; and also library.

According to the observation and interviews with students, the learning process in Nguyen Tat Thanh High School is going fun. In the learning process, the teachers not only teach the material but also the life skill, both in extra classes or outdoor activities provided by school. The innovative teachers make the students interest in chemistry, they always have something new to be given to the students for the learning process. Sometime teachers use discussion, presentation, debate, question-answer, or experiment to learn Chemistry. Teacher also sometimes made a worksheet for students. Elements Periodic Table is one of Chemistry materials that students learn. It was learnt on October and teacher used power point presentation as the media and discussion and question-answer as the method to explain it. However, the power point media that teacher used in elements periodic table chapter was still one way learning, had too much texts and the colour combination between texts and background sometimes was not suitable. Power point presentation was only helped teacher to explain the material and the interaction between teacher, media and students was not visible.

Media is one of factors that can make a learning process is going effectively. Media can prevent misconception in the learning process. Supposing that teacher explain an atom theory, it needs a media to make a student understand enough the shape of an atom because teacher impossible brings an atom to the class. Buckingham (2007) said that medium as an intervening means instrument or agency: it is a substance or a channel through which effects or information can be carried or transmitted. A medium is something we use when we want to communicate with people indirectly, rather than in person or by face to face contact. This dictionary definition tells us something fundamental about the media, which forms the basis of the media education curriculum.

Yang *et al.* (2013) said that incorporated with some cognitive theories, Mayer and colleagues purposed the theory of multimedia leaning which emphasize the role of experience and ability in learning from various nonverbal representations including pictures, animations and narrations; also in addition, taking the idea from negative theory, Mayer further pointed out that meaningful learning in multimedia environments occurs when learners select relevant information, coherence principles, modality, individual differences, and so forth and these principles to date have become the major guidelines for designing multimedia instruction.

One of media which can enhance learning process is animation media. Animation media is a computer based learning media in an animation form that visualize Chemistry concept (Mawarni, 2015) and can prevent student misconception (Fitriyah & Sukarmin, 2013). Other media which can be used in the learning process is interactive multimedia. An empirical research shows that using computer based media with multiple representatives effectively help students to understand chemical phenomenon deeply (Levy & Wilensky, 2009). Education game also one of interactive multimedia that increase use in chemistry learning. Education game is developed to interest the students in learning process so that will increase students' motivation (Sari, 2014). Besides, game also makes students feel comfort and happy in the learning process so can increase learning outcome (Heriyanto, 2014).

Hence, in this study the writer wants to develop an interactive multimedia for elements periodic table learning process in Nguyen Tat Thanh High School. The writer also wants to analyse the feasibility of the media which has developed.

### Method

Elements Periodic Table was conducted arithmetic and memorized so it needed additional media to make it easy for student to learn it. The investigation that the writer used was a Research and Development. This study method aimed to produce a product and tested the effectiveness of it (Sugiyono, 2010: 407). Model of development that the writer used was ADDIE (Analysis, Design, Develop, Implementation dan Evaluation) (Mulyanta, 2009).

The design of ADDIE model began with analysed the problems and potency of the school and did the literature review in accordance with the problems. Then made the design to create elements periodic table interactive multimedia. Elements periodic table interactive multimedia developed with software Adobe Flash that could made animations and combine texts, graphics, symbols, audio, and video so made the instructional media more interesting for student (Suyanto 2003). Development of element periodic table interactive multimedia was done in several stages: the initial product development stage, initial product validation by experts, and small-scale tests. Once the product was validated by experts then revised initial products. Likewise after a small scale test it revised based on feedback from students as respondents in order to obtain a good learning media and ready to be used on a larger scale. Then the product tested on large scale. After that, students did the post test that aimed to determine the level of students' understanding of the concept and determine the response of students after using elements periodic table interactive multimedia in the learning process. The data obtained was used to make improvements in order to get the final product.

In conducting this research, the writer involved media expert, instructional expert and respondents. Collecting data from this study was done in three ways: 1.) Observation was used to see the situation on the class. 2.) Questionnaire was conducted to obtain information from experts and respondents related learning media that has been developed. 3.) The test method was used to measure students' understanding of the elements periodic table concept that had delivered by elements periodic table interactive multimedia that has been developed.

Instruments in this research and development used to assess the validity, feasibility, effectiveness, and the responses of students to elements periodic table interactive multimedia. The instrument used in the form of test instruments and non-test instruments. Cognitive test instrument that used as a post-test was in a description form and grading criteria was using the formula used by Mardapi (2008). Non-test instrument was a questionnaire to instructional experts and media experts to validate the feasibility of learning media and to students for giving responses and validation using content validity (Sugiyono, 2010) and reliability of the questionnaire was tested using Cronbach alpha coefficients. Students' responses questionnaires were in qualitative data form and consist of five possible answers: strongly agree (SA) 4 score, agree (A) 3 score, disagree (D) 2 score, and strongly disagree (SD) 1 score. Data analysis of students' responses

questionnaire was in descriptive and qualitative analysis. The grading criteria also used the formula of Mardapi (2008) that had been modified.

### Findings and Discussion

Elements periodic table interactive multimedia is a learning media that developed using Adobe Flash software and can be used on a laptop or PC. In this study, elements periodic table interactive multimedia used as a supporting material that help teacher and students in the learning process and there is an animation game that has interesting combination of colour and shapes in addition to make students interest in studying chemistry with enjoyable learning.

Elements periodic table interactive multimedia is divided in to some parts: (1) initial appearance (Universitas Negeri Semarang and Nguyen Tat Thanh High School logo), (2) main menus (material menu, gallery menu and exercise menu), (3) sub menus, and (4) additional menu (developer profile). Main menu buttons have different shape and size with additional buttons to indicate the different of focus point between them.

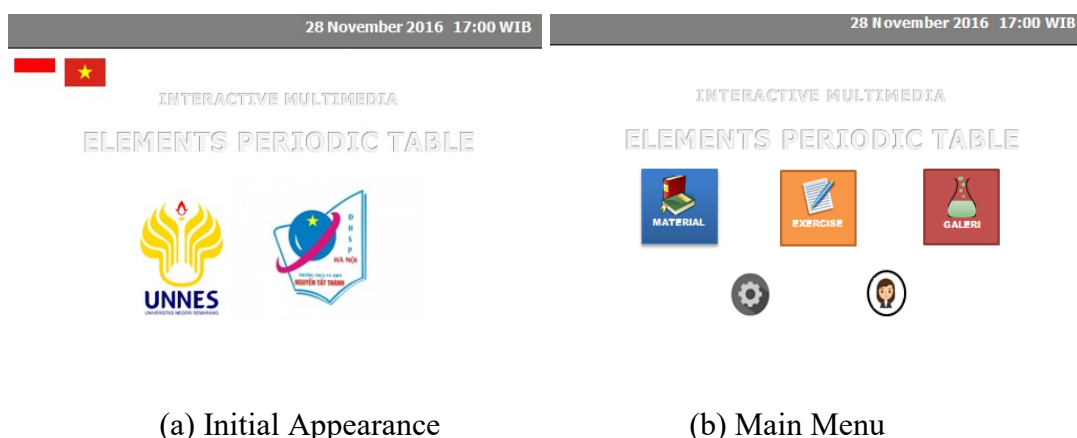
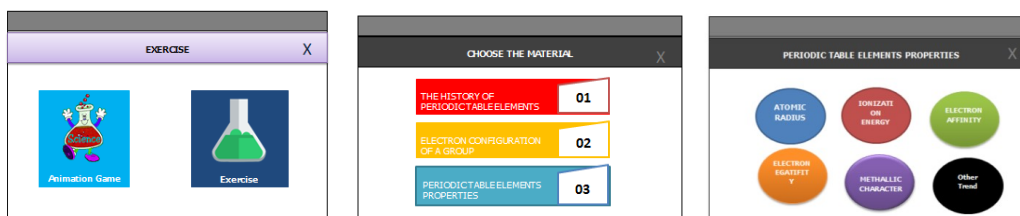


Figure 1. Design of Elements Periodic Table Interactive Multimedia

Selection of colours used in the development of this medium was based on the psychological responses of students as users. This is because the colour is the first thing that student will see and it plays an important role in the perception and interpretation of students' views of instructional media. Buttons have pastel colour because they are eye catching and white as the background because white will make button pastel colour on the background looks shiny and readable.

The buttons on main menu are material, exercise and menu. Material consists of the history of periodic table elements, electron configuration of a group and periodic table elements properties. Exercise consists of animation game and exercise. Animation game is an education game about elements periodic table and exercise is a packet of description questions. Gallery consists of animation video about elements periodic table, a funny way to easier remember elements and some amazing chemistry reactions. There is also additional menu in elements periodic

table interactive multimedia. Additional menu consists of developer profile. Submenus are in Figure 2.



(a) Submenu Exercise      (b) Submenu Materials      (c) Submenu Periodic Table

Figure 2. Submenus Design of Elements Periodic Table Interactive

One of steps to test the feasibility of elements periodic table interactive multimedia as a learning media was validation from media expert and instructional expert. The validation results are in Table 1 for media expert and in Table 2 for instructional expert.

Table 1. Validation Average Score of Elements Periodic Table Interactive Multimedia for Media Expert

Aspects	Average Score	Average Maximum Score
Linguistic	4.00	5.00
Software Engineering	4.41	5.00
Learning	4.00	5.00

Table 2. Validation Average Score of Elements Periodic Table Interactive Multimedia for Instructional Expert

Aspects	Average Score	Average Maximum Score
Linguistic	4.00	5.00
Contents Standard	4.33	5.00
Learning	4.38	5.00

Based on Table 1 and Table 2 the highest score from media expert was on software engineering aspects and the score was 4.41 from the average maximum score was 5.00. The highest score from material expert was 4.38 from the average maximum score was 5.00 on learning aspects.

The average score of validation results from media expert was 4.13 from the average maximum score was 5.00. It showed that elements periodic table interactive multimedia was compiled the requests of linguistic, software engineering and learning aspects. It also showed that the maximum score was on software engineering aspect reach 4.41 points, so elements periodic table interactive multimedia was effective and efficient as instructional media, good management, easy to use, compatible, good voice control, good animation, suitable layout, and high quality of interaction between user and media. The

average score of validation results from material expert was 4.24 from the average maximum score was 5.00. It showed that elements periodic table interactive multimedia was fulfil the requests of linguistic, content standard and learning aspects. The highest point was on learning aspect reach 4.38 points shows that elements periodic table interactive multimedia was compiled as a learning media with suitable material for learning and suitable for learning aims, had influence for students and had interactive communication.

Score from media expert is 96 from the maximum score 110 with very feasible category and score from material expert is 62 from the maximum score 75 with feasible category based on Table 3 and Table 4. It shows that elements periodic table interactive multimedia is feasible to use as a learning media. Advices from the experts use to improve the learning media before it is used to take the data. The advices are shown on Table 5 and Figure 3.

Table 3. Feasibility Criteria of Elements Periodic Table Interactive Multimedia based on Media Expert Validation Sheet

Interval	Criteria
$92 < \text{score} \leq 110$	Very Feasible
$74 < \text{score} \leq 92$	Feasible
$56 < \text{score} \leq 74$	Fairly Feasible
$38 < \text{score} \leq 56$	Not Feasible
$20 < \text{score} \leq 38$	Very not Feasible

Table 4. Feasibility Criteria of Elements Periodic Table Interactive Multimedia based on Material Expert Validation Sheet

Interval	Criteria
$63 < \text{score} \leq 75$	Very Feasible
$51 < \text{score} \leq 63$	Feasible
$39 < \text{score} \leq 51$	Fairly Feasible
$27 < \text{score} \leq 39$	Not Feasible
$15 < \text{score} \leq 27$	Very not Feasible

(Mardapi, 2008)

Table 5. Advices from Experts

Advices	
1	Back sounds are too loud, turn down the volume of the back sounds. Write down the instruction so the students can know the instruction clearly.
2	Make the question to the points so it will not make confuse the user.

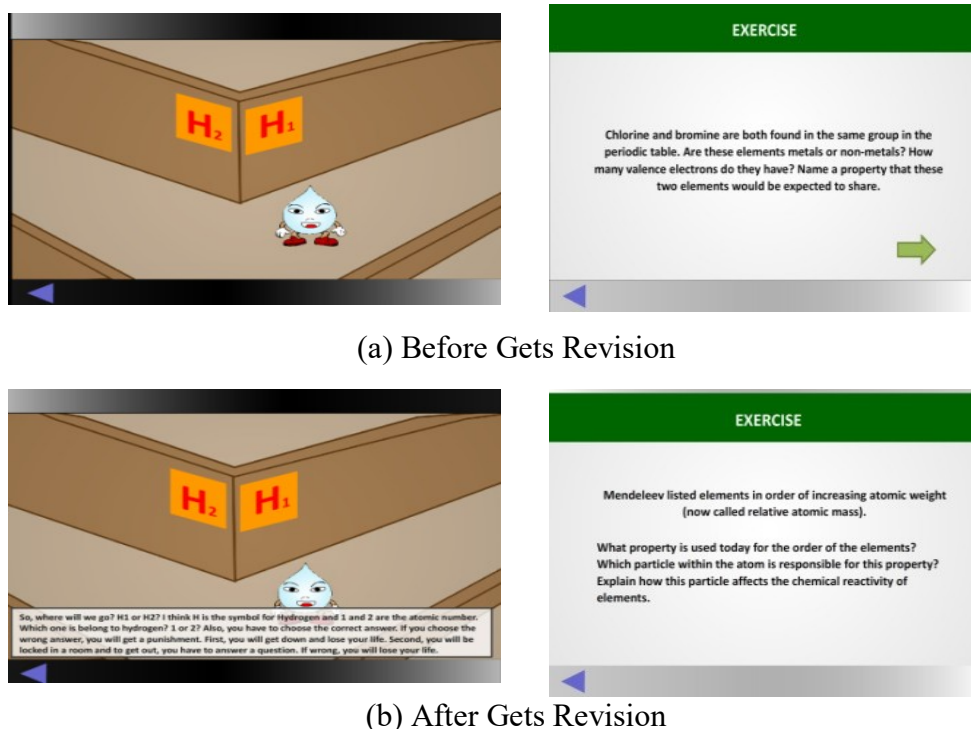


Figure 3. Appearance of Elements Periodic Table Interactive Multimedia

Small-scale test used to know the students response before the elements periodic table interactive multimedia tested in the large scale, also used to know the reliability of students responses questionnaire. Small-scale test was done in Nguyen Tat Thanh High School used nine students of eleventh grade who were selected using purposive sampling technique. Students asked to know the menus of elements periodic table interactive multimedia then operated it. Students also asked to watch the design, video and animation of the multimedia. After that, students gave comments about them. Based on the data, the reliability was 0.83 categorized as reliable questionnaire and the average of students' responses was 69.97 categorized as very good responses. Scores of small-scale test are in Table 6.

Table 6. Score of Small-Scale Test for Elements Periodic Table Interactive Multimedia

Class	Respondent	Score
Upper	UC-23	64
	UC-14	66
	UC-06	65
	UC-28	80
	UC-15	66
	UC-01	65
Lower	UC-08	66
	UC-22	80
	UC-11	75

Students' responses data from large-scale test provided information on students' acceptance response to elements periodic table interactive multimedia during the learning process on large-scale tests. The average results from students responses was 68.5. It was very good response. Recapitulation data was presented in Table 7.

Table 7. Recapitulation Data of Students' Responses to Elements Periodic Table Interactive Multimedia on Large-Scale Test

Score Interval	Criteria	Number of Students
$68 < \text{score} \leq 80$	Very Good	15
$56 < \text{score} \leq 68$	Good	17
$44 < \text{score} \leq 56$	Fairly Good	2
$32 < \text{score} \leq 44$	Less Good	0
$20 < \text{score} \leq 32$	Poor	0

Table 8. Students Comments and Advice to Elements Periodic Table Interactive Multimedia on Large-Scale Test

Advice and Comments	
UC – 30	I like this lesson so much, learn chemistry in Vietnamese is not enough, we could learn chemistry in English in funny way. I love the teacher. She is adorable one!
UC – 32	I like game. So I like this learning way. And I think you are a good teacher!
UC – 26	This is great! I love this teaching method. Anyway, I think it is important to take more focus on the design. 4 of 5!
UC – 21	The lesson is very good, I learn very much about chemistry in English.
UC – 16	Needs higher image resolution and animation also needs some magnet to automatically suck in what mouse dragging in to.

The effectiveness of elements periodic table interactive multimedia showed in students post test result. Post-test was conducted on learning process after elements periodic table was taught by using elements periodic table multimedia. The medium is effective if the post test results meet classical completeness after learning process is aided by the multimedia. Based on Education Ministry of Indonesia (Trianto, 2010: 241) classical completeness that has to be complied is  $\geq 85\%$  of students' post test is above 75. But according to Trianto (2010: 241) based on national standard curriculum, the determination of classical completeness is determined by each school based on the facility and other component of the school. In this study, classical completeness that has to be met is 58% of students' post test is above 75. This is based on students test result of the last chapter and the minimum mastery criteria of the school. According to Figure 4 the number of students who get  $\geq 75$  was 21 from 34 students and the number of students who get  $\leq 75$  was 13. From that, we know that the percentage of students who get  $\geq 75$  was 62%. So, elements periodic table interactive media was effective to use in the learning process. And the result is in Figure 4.



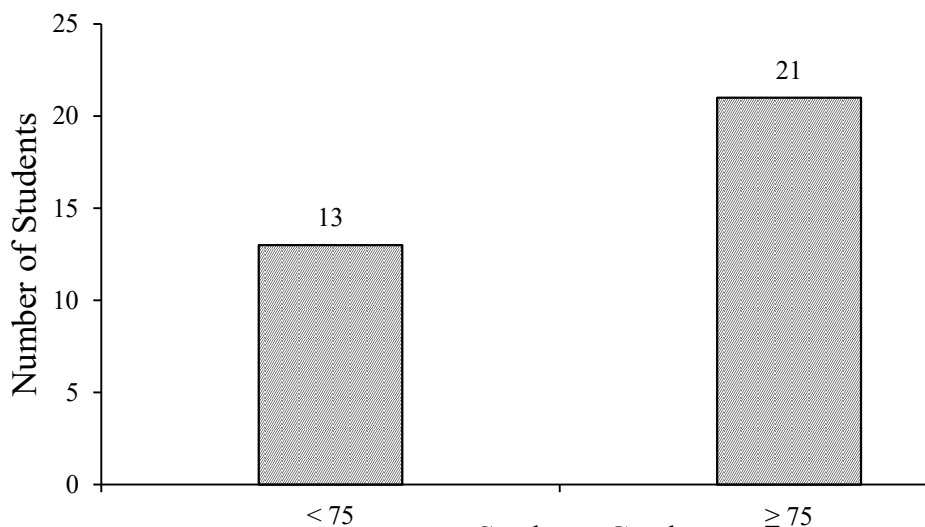


Figure 4. Students Post Test Grade

Adhitama's (2015) study showed that according to questionnaire and observation form, science learning interactive multimedia could improve self-motivated learning 19.14%. Syifaunnur (2015) made an interactive multimedia that combine macroscopic level, submicroscopic level and symbolic level in learning chemistry. The difference of this study and Adhitama's (2015) study is in Adhitama's (2015) study studied self-motivated learning of student and in this study, studied the effectiveness shown by post-test result and from Syifaunnur's (2015) study the difference is in the product. In this study we focused on the game at evaluation process. So we can integrate that an interactive multimedia could make learning process going more fun, increase self-motivated and combine macroscopic level, submicroscopic level and symbolic level.

### Conclusions

Based on the study result of elements periodic table interactive multimedia, it can be concluded that based on validation result from the experts, elements periodic table interactive multimedia comply linguistic aspect, software engineering aspect, visual and audio aspect, and learning aspect. Elements periodic table interactive multimedia was effective as a learning media, shown by large scale test results that 21 of 34 students had  $\geq 75$  score on the post test and students' response on small scale tests was 69.97 with very good response category and on large scale test showed 68.5 categorized as very good response.

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